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ABSTRACT

Orienting responses to visual and auditory stimuli were compared in 3 cohorts of preterm infants born between 1977 and 1987. The sample consisted of 128 infants born between 1977 and 1979, 129 infants born between 1980 and 1983, and 94 infants born between 1984 and 1987. The sample was divided into one group of 140 infants born between 25- and 34-weeks gestation age, and one group of 211 infants born between 35- and 37-weeks gestational age. Ratings were made of orienting responses to a bulls-eye, rattle, bell, voice, and combined face and voice; the orienting items were adapted from the Neonatal Neurobehavioral Assessment Scale. For the 25-to-34-week group, there was a significant difference between cohorts on orienting to rattle, with performance increasing for the more recently born infants. There were significant differences between cohorts in the 25-to-34-week group on orienting to bulls-eye, rattle, and face plus voice. For the 35-to-37-week group, there was a difference between cohorts on orienting to bulls-eye. The infants were assessed when they were medically stable (mean age, 18 days). These results demonstrate a significant change in auditory and visual orienting for preterm infants between 1977 and 1987. The fact that most significant changes were observed among the younger, higher-risk preterm group suggests that medical improvements have resulted in improved outcomes for preterm infants. (RH)

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Preterm Infants' Orienting Responses: Improvements Over Time

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ABSTRACT

Orienting responses to visual and auditory stimuli were compared in 3 cohorts of preterm infants born between 1977 and 1987. The sample consisted of 128 infants born between 1977 and 1979, 129 infants born between 1980 and 1983, and 94 infants born between 1984 and 1987. Ratings were made of orienting responses to a bulls-eye, rattle, bell, voice, and face plus voice combined. The sample was divided into one group of 140 infants born between 25 and 34 weeks gestational age, and one group of 211 infants born between 35 and 37 weeks gestational age. For the 25 to 34 week group, there was a significant difference between the cohorts on orienting to rattle, with performance increasing for the more recently born infants. Comparison of the infants' best responses (i.e., highest scores) to each item indicated that, for the 25 to 34 week group, there were significant differences between the cohorts on orienting to bulls-eye, rattle, and face plus voice. For the 35 to 37 week group there was a difference between the cohorts on orienting to bulls-eye. These results have demonstrated a significant change in auditory and visual orienting for preterm infants between 1977 and 1987.

INTRODUCTION

Recent improvements in neonatal intensive care have led to lower rates of mortality and morbidity in preterm infants. A crucial question that arises is whether the behavioral outcome of the preterm infant has improved concurrent with the improved medical outcome. One approach to this problem is to compare different cohorts of preterm infants on behavioral criteria which may provide information on the status of neurological outcome. For this purpose, the present study compared orienting responses to visual and auditory orienting items from the Neonatal Neurobehavioral Assessment Scale in 3 cohorts of preterm infants.

METHOD

Subjects. The sample included 351 preterm twins (161 male, 190 female) participating in a study of behavioral patterns during the neonatal period. The infants were born at the 6 area hospitals within one community that have obstetrical units (3 of which have intensive care nurseries); thus, the entire range of socioeconomic status was represented in the sample. Birth gestational age ranged from 25 to 37 weeks. The infants were assessed when they were medically stable, just before discharge from the hospital (range = 2 to 159 days; mean = 18 days. Five infants were more than 2 months of age as follows: 1 each of 75 days, 105 days, 136 days, 137 days, and 159 days.)

The 3 cohorts consisted of 128 infants born between 1977 and 1979, 129 infants born between 1980 and 1983, and 94 infants born between 1984 and 1987. Because degree of prematurity may affect outcome, the infants were divided by gestational age at birth as follows: one group of 140 infants born between 25 and 34 weeks gestational age, and one group of 211 infants born between 35 and 37 weeks gestational age.

Procedure. The orienting items were presented to the preterm infants as part of the larger comprehensive assessment of behavior. The orienting assessment was conducted midway between two feeding periods while the infant was in an awake state. Positioning of the infant for each test item was as follows: for the bulls-eye, infants were held in an upright

position with the head and back supported, the infant "seated" on the examiner's lap; for the rattle and bell, infants were supported in a semi-supine position on the examiner's lap; for voice and face plus voice, infants were held under the arms in an upright position. The infant's head was placed in the midline before each trial. The presentation of the items was randomized with the presentation of other items in this part of the assessment to prevent habituation to any individual item. The orienting items, adapted from the Neonatal Neurobehavioral Assessment Scale (Kurtzberg et al. 1979), were as follows.

I. Visual following of a bulls-eye. A black and white bulls-eye was presented at the midline of the infant's face. If the infant fixated, the bulls-eye was moved 90° to one side and then 90° to the other side. The initial movement was made to the right two times and to the left two times. Possible responses were: 1. no following response; 2. fixates, brief transient following; 3. fixates, intermittent good following; 4. sustained fixation, following with head and eyes.

II. Orienting to rattle. A standard rattle from the Bayley Scales of Infant Development (1969) was presented three times 30 cm to the right side of the infant's head, and out of view, and three times to the left. Possible responses were: 1. no orienting response; 2. quieting, eyes brightening and widening; blink, no eye movement; 3. quieting, eyes brightening

and widening, some searching movements with eyes only; 4. eyes brightening and searching with head turning to side of sound.

III. Orienting to bell. A standard bell from the Bayley Scales of Infant Development (1969) was used. Presentation and scoring were the same as for the rattle.

IV. Orienting to voice. For this item the examiner spoke to the infant, saying "Hi baby," "Hi (baby's name)," etc. Presentation and scoring were the same as for the rattle.

V. Following face plus voice combined. For this item the examiner held the infant in an upright position, the infant's face approximately 15 cm from the examiner's. The examiner attempted to capture the infant's visual fixation; if successful, the examiner slowly moved 90^{o} to one side of the infant, then back across the midline 90^{o} to the other side, smiling and talking to the infant the entire time. The initial movement was made to the right two times and to the left two times. Possible responses were: 1. no fixation on face; 2. fixation, brief transient following; 3. fixation, intermittent good following; 4. sustained fixation, steady following with head and eyes.

RESULTS

To determine if there were differences in the average orienting responses between the 3 cohorts of preterm infants, an analysis of variance was computed on the average scores for each orienting item: bulls-eye, rattle, bell, voice, and face plus voice combined. The results, presented in Table 1, indicated that, for infants born between 25 and 34 weeks gestational age, there was a significant difference between the cohorts on orienting to rattle, with average performance increasing for the more recently born infants. Further analyses indicated that infants born between 1984 and 1987 had significantly higher average scores on orienting to rattle than infants born between 1977 and 1979. No significant differences across cohorts were observed for average scores for infants born between 35 and 37 weeks gestational age.

The above results suggested that, at least for the 25 to 34 week group, there was some improvement in average orienting responses for infants born in more recent years when compared with infants born in earlier years. Therefore, an attempt was made to determine if more information about changes in performance over time could be obtained by examining the scores in more detail. For this purpose, orienting responses across cohorts were compared using the infants' best scores (i.e., highest scores) to each item as a measure of capability at the time of assessment.

Analyses of variance were computed using the best, or highest, scores for each of the orienting items for each gestational age group. These results also are presented in Table 1. For the 25 to 34 week group, there were significant differences between the cohorts on orienting to bulls-eye and orienting to rattle, with a trend for orienting to face plus voice combined. Further analyses indicated that infants born between 1980 and 1983 and between 1984 and 1987 had higher scores on orienting to bulls-eye and orienting to face plus voice combined than infants born between 1977 and 1979: t (109) = -3.24, p <.002; t (86) = -2.92, p <.005; t (109) = -2.01, p <.05, t (86) = -1.89, p <.07, respectively. In addition, infants born between 1984 and 1987 had higher scores on orienting to rattle than infants born between 1977 and 1979: t (86) = -2.52, p <.02.

For the 35 to 37 week group, the results of analyses of variance, presented in Table 1, demonstrated a significant difference between cohorts on orienting to bulls-eye. Further analyses indicated that infants born between 1980 and 1983 and between 1984 and 1987 (trend) had higher scores on orienting to bulls-eye than infants born between 1977 and 1979: t (139) = -2.27, p <.03, and t (128) = -1.87, p <.07, respectively.

CONCLUSIONS

1) There have been significant changes in auditory and visual orienting responses for preterm infants assessed between 1977 and 1987.

2) As orienting responses are considered to be important in the assessment of the integrity of the central nervous system, they are a significant index of behavioral outcome.

3) These findings also have demonstrated the value of more detailed examination of the orienting response (i.e., using best responses) for obtaining information about changes in preterm infants' responses across time.

4) It was the younger, higher-risk preterm group (i.e., those born between 25 and 34 weeks gestational age) for which most of the significant changes across cohorts have been observed.

5) Although this study cannot address cause and effect for these results, such changes in scores concurrent with changes in neonatal intensive care suggest that medical improvements during these years have resulted in improved outcome for preterm infants in at least one behavioral area. In any event, there is evidence that the preterm infant has changed across time.

Table 1

Significant Changes in Orienting Responses by Birth Gestational Age Group: Average and Best Scores

	Cohort Years								
	1977-1979		1980-1983		1984-1987				
	M	SD	M	SD	M	SD	F	df	Significance
Average Scores[1]									
25 to 34 weeks									
Rattle	5.6	1.80	5.9	1.70	6.6	1.80	3.36	2,135	p <.04
Best Scores									
25 to 34 weeks									
Bulls-eye	2.5	1.10	3.2	.92	3.2	.70	7.62	2,135	p <.0007
Rattle	3.5	.65	3.7	.59	3.8	.40	3.62	2,135	p <.03
Face plus voice	1.9	.93	2.2	1.00	2.3	.94	2.72	2,135	p <.07
35 to 37 weeks									
Bulls-eye	2.6	1.10	3.1	1.00	3.0	.82	4.33	2,198	p <.02

Note: Sample sizes were as follows: 25 to 34 week group, 1977-1979 = 61; 1980-1983 = 51; 1984-1987 = 28.
35 to 37 week group, 1977-1979 = 67; 1980-1983 = 78; 1984-1987 = 66.

[1] In computing average scores, the original scores were converted to a 9-point scale to make the range of scores comparable to other items in the neonatal assessment.